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ABSTRACT

This paper addresses students' affect toward mathematics in relation to the learning environment created by the teacher through the analysis of the mathematical autobiographies of students at four different institutions of higher learning in the Southeast. Most of the students were in teacher education programs. The original intent was to compare students' affect toward mathematics with their mathematical experiences in elementary school. Information provided in the writings of the students is multi-faceted. Results revealed that the dedicated teachers who empowered students to reach their full potential inspired others to become teachers. It is concluded that all teachers should realize the scope of their influence and see the learning environment they create through the eyes of their students. (ASK)

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Fostering Disposition Toward Mathematics

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Over the past four years the authors of this article have obtained the mathematical autobiographies of students at four different institutions of higher learning in the Southeast. While the authors' original intent was to compare students' affect toward mathematics with their mathematical experiences in elementary school, the information provided in the writings of the students is multi-faceted. This article addresses students' affect toward mathematics in relation to the learning environment created by the teacher.

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Most of the students were in teacher education programs. They represent traditional as well as non-traditional students; undergraduate as well as graduate and students in a post-baccalaureate initial certification program. While most of the students were pre-service elementary or middle grades teachers, some were pre-service secondary mathematics teachers. That preservice elementary teachers are especially prone to mathematics anxiety was a conclusion of Hembree's (1990) meta-analysis of 151 studies.

A Longitudinal Study of American Youth (Reynolds, 1992) concluded:

> Mathematics attitude. . . appears to require qualitative components as reflected by students' perceptions of their teacher's clarity of expression and instructional support. It appears, for example, that students are more likely to acquire favorable attitudes toward mathematics if they perceive the classroom context (e.g., teachers) in a positive light. (p. 324)

For many students their perceptions about mathematics are inextricably tied to their perceptions of their teachers. One student clearly realized this as she wrote:

> My interest in math had a lot to do with my teachers and the way they taught. All of my teachers during my early years were patient, understanding, and helpful. They created an environment so their students wanted to learn. I can remember the colorful classrooms, the many fun and exiciting math activities that we did daily. My second grade teacher, Mrs. Bolton, gave us assignments that were exciting such as math games. She used games a lot, and this, I think, made it easier for us because as children, we were able to relate to numbers better because of previous experiences with games. This taught us that math could be fun. At last, Ms. James, fifth grade,was indeed my favorite class. At this time, we changed classes for different subjects. Ms. James was a math whiz who actually expected me to be the same. This put pressure on me, but it was good pressure, if that makes any sense. Ms. James was someone every student respected, so it was important that I did her work and did it right.

> Her presence made me want to do and learn more. She was hard and tough, but it was known that she was like that for her students. Whenever we went on field trips, Ms. James somehow related them to math. We knew that field trip time was not "play time," as we would have liked them to be, because we knew there would be some kind of assignment that would be given by Ms. James. So, we went on field trips prepared and ready to please Ms. James when we got back; we never wanted to disappoint her--she was great!

Another student was able to generalize the strong association of teacher qualities with perceptions of experiences, although her recollections were not completely positive:

> The experiences of mathematical learning that I am able to recall are associated with the teacher who taught them to me. I didn't like my first grade teacher, and I can't remember anything she taught me. However, I can remember quite vividly that at that young age she paddled me in front of the class! I loved my 2nd, 3rd, and 5th grade teachers, and I can recall valuable lessons, school and life, that each of them taught me.

Other students recalled specific instances that had profound effects on them. One recounts:

> I was in second grade when I was first introduced to multiplication. I remember being given a worksheet in which we had to color by number according to the answers we got. I was paralyzed. I had no idea how to do it so I copied it off the person sitting next to me. Then the teacher posted them on the windows (what a great activity, and so worthy to decorate a room, not).

Another remembered:

> One year, my class was working on drill and practice of writing numerals. I was in the medium level of my math classroom. The teacher came over my shoulder and blessed me out for writing my two like this: 2

instead of like this: 2 . This was truly my only memory of math since then (3rd grade). To this day I write my two's like this: 2 in fear that I will be in trouble. I know it sounds crazy.

For one student square roots provided a vivid memory:

> Unfortunately, my most vivid memory was learning how to compute square roots in the 4th grade. The teacher gave us a test over the material. I remember making a D for the first time! I was so upset because she did not check for comprehension or understanding, and moved through the material too fast to be learned. When I asked her how to do square roots and what I could do to help my grade she became very upset and made me feel inferior to say the least. I then hated math even though I was very proficient with numbers.

Final examples of profound effects of specific experiences are provided by a student who had no trouble verbalizing her feelings:

> In fourth grade I can remember drilling multiplication facts day in and day out with Mrs. J. A. (imagine the most unfriendly and prickly girls school teacher, double it and you have Mrs. A.) I sat next to a girl who was very quick with her multiplication facts. .. Tammy P. I remember constantly feeling pressured to come up with the answer before Tammy. I ended up feeling so flustered that I NEVER raised my hand. Mrs. A felt I was an "unsatisfactory participant." (Of course, I did not adore her either.)
>
> In fifth grade we were deep into division with remainders. Mrs. Nancy W., again not one of my best beloved teachers, gave us a division test. At the end of the day she handed back our tests as we walked out the classroom door. She handed me my paper and said, "If you do not bring this back signed tomorrow I will give you an F in conduct." I cringed at the thought of my parents' reaction to my glowing 30. I was usually a good student. As I look back on this incident today, as a teacher I am appalled that Mrs. W. did not realize that I might not have understood the material (my parents were aware enough to get me a tutor who helped me tremendously.) To this day, I am still leery of having

> to do division on the spot. I am not sure how much of my attitude towards math is a reflection of my real feelings about math or my feelings about the two former teachers. A part of me always wishes to show those teachers how well I did in math in my future years as well as letting them know what I think of them as teachers.
>
> Geometry came in the ninth grade. I loved Mrs. Brookeshire! I would have lept tall buildings in a single bound for that woman. Not only did Mrs. Brookeshire take the time to explain things to the fullest extent, she asked us if we understood as well! (Imagine that!) If we had difficulty grasping a concept. . .lo and behold. . . she would explain it AGAIN! Geometry was by no means easy. I could never quite see planes that did not fly. Nonetheless, I took her word for it.

The selectivity of the memory and the impressions left on students are intriguing. Out of many of the specific instances, however, general traits are identifiable. Chapman (1996) listed factors that preservice teachers disliked about mathematics and the way it was taught. That list included intimidating teachers; teachers' jumping on students when students were wrong; being made to feel inadequate if the student does not understand; teachers' not going over all the steps; teachers' not understanding why students do not understand; teachers' not offering encouragement; and teachers' bad moods and not smiling. Teacher qualities examined by Haladyna, Shaughnessy, and Shaughnessy (1983) included enthusiasm, respect, commitment to help students learn, providing individual attention, fairness, and praise and reinforcement. They concluded: "Teacher quality, as determined from student self-

reports, seems to be consistently related to mathematics attitude at all grade levels." (p. 28)

A graduate student who teaches middle grades math at a private school related the intimidation and humiliation she had experienced in high school:

> Math became my best subject in high school. I did great in algebra. Trig and calculus were very hard for me. I was always three weeks behind. I do remember when I thought I had found a better way to do a problem. All my answers were wrong. When Mr. S. put the problems on the board he was "kind" enough to put the way I did the problem off to the side. He really made me feel like an idiot. There were lots of similar incidents with Mr. S.

That strong mathematics students are made to feel less than adequate is further evidenced by the conclusions of a computer science major drawn from his experience in a probability and statistics course:

> The one goal the teacher had set was to show just how smart he was and how stupid the class was. That class made me realize I had to drop my math major so I would never be unfortunate enough to have him again. So now I am only minoring in math with hopes to at least achieve that much of a subject I once loved.

The analogy has been tossed around in recent years that mathematics has been serving as a filter rather than a pipeline. In the quest to empower all students mathematically, perhaps note should be taken that a mathematics teacher rather than the mathematics itself sometimes causes the filtering. A student who recently graduated with a double major in mathematics and history makes the following allusion:

> In high school, I eventually reached A. P. Calculus my senior year. I got a 5 on the A. P. . . . When I started getting ready for college, math was really the only thing that I seriously considered majoring in. I was planning on becoming a math professor.
>
> I'm now a senior in my last math class ever. I no longer intend on pursuing math at the graduate level. That is why I added another major, European studies. Somehow, I've lost my enjoyment of math. I have my own theories for how that happened, but those don't really matter. I still appreciate the beauty of math, but I haven't really enjoyed the process of learning and doing math since somewhere in the middle of my freshman year. Maybe after a few years without any math classes, I'll find that I am interested in learning more math again, but that remains a question for the future.

The anecdotes are clear. From teacher eyes' rolling every time a multiplication fact was missed to being snapped out of a trance and feeling all eyes in the classroom focused on a particular student, the tales unfold. The result-- one student summarized: "At reunions Mrs. A. horror stories are always told."

Other complaints from students whose autobiographies were collected included grade inflation; teachers who ate, read the paper, or fell asleep after giving the daily assignment; the creation of anxiety about topics to come (multiplication, division, fractions, algebra); and gender concerns (having almost all math teachers who were male; feeling male teacher had no patience with female students nor concern as to whether they understood).

On the other hand, students recount how their self-esteem has been boosted by one classroom episode; how teachers have inspired them,

how teachers have demonstrated creativity; and how teachers have provided extra help. Describing the "patience and kind heart" of "Mrs. H.," one student felt that "...if Mrs. H had not taken the time to help me I would have been eternally lost in mathematics." Another spoke of a teacher who "continually encouraged me to persevere."

Not only do most students have difficulty separating their feelings about mathematics from their feelings about mathematics teachers, but also they have difficulty separating their feelings about mathematics/ mathematics teachers from the grades they received in the courses or their perceived success. One student was an exception. After a lengthy discussion which contrasted several of her teachers, she focused on Mrs. Brown:

> The best experience I ever had and probably the hardest was advanced algebra/trigonomety with Mrs. Brown. I have never worked as hard as I did in that class. She always talked about the QCC's (quality core curriculum objectives) and how math applies to real life. Never did she not fulfill her job as an instructor. After the first day I wanted to drop the class but she wouldn't let me. I didn't do that great in the class, but I did honestly try my hardest. I wish I could have had eleven other Mrs. Browns for all the other years I was in school.

In conclusion, reading students' mathematical autobiographies does not cause one to note so much whether their teachers were "sages on the stage" or "guides on the side" as whether the teachers displayed sensitivity to affective concerns. Students recall teachers' not

remembering their names; their feelings upon moving to a new school; sweaty palms; feeling their teacher did not like children; and feelings of embarrassment.

The Professional Standards for Teaching Mathematics (NCTM, 1991) state: "Creating an environment that supports and encourages mathematical reasoning and fosters all students' competence with, and disposition toward, mathematics should be one of the teacher's central concerns" (1991, 61). That document emphasizes the role of the kinds of mathematical tasks given students and the role of mathematical discourse in creating such an environment. It calls for assessment of a teacher's fostering of students mathematical dispositions. That assessment "should focus on whether the teacher facilitates students' flexibility, inventiveness, and perseverance in engaging mathematical tasks and on whether students demonstrate confidence in doing mathematics." (p. 104). It specifically calls for teachers to be nonjudgmental when students give answers or present solutions and to recognize mistakes as a natural part of the learning process.

One student wrote: "In my experience, I can see how a good teacher can influence a student to like math and how a poor teacher can turn even good students into poor students." In Skemp's (1971) words:

> . . . a good teacher can, by initially asking questions which he knows that the student can answer, reduce anxiety and build up confidence, and thereby improve

> the performance; while another can reduce an averagely intelligent pupil to tongue-tied incompetence. (p. 128)

The dedicated teachers who empower students to reach their full potential have inspired others to become teachers. May all teachers realize the scope of their influence and see the learning environment they create through the eyes of all their students.

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